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progress, correlations, and details of teaching. Correspondence, criticisms, and pertinent questions are invited. The members of the faculty of the School of Education have one purpose, and that is to assist all their fellow-teachers in studying the art of all arts.

NATURAL SCIENCE.

WILBUR S. JACKMAN.

DURING the month of October the work in nature study will be based upon the materials observed and gathered during the field trips. These will include studies of the sand-dune region, embracing lakeshore, dry dune, and marsh areas; of the north shore district, including dry upland as well as shore areas; also studies of inland wooded and prairie areas, as well as the valley region bordering the drainage canal. Among the topics to be considered may be mentioned:

1. *Plant and animal life*.—1. In the marsh areas: (*a*) The regular succession of plants from the dry, high shores toward the middle of the water area. (*b*) The adaptation of root, leaf, and stem to the water environment; to growth in the mud; to growth in the dry soil. (*c*) The disappearance of characteristic plants as the lakelet becomes filled or drained. (*d*) The appearance of new plants. The characteristic animals of the marshes, especially the birds. Their adaptations to the water; to the mud, to the vegetation, and to the lakeshore. The succession of animal forms during the transition period from the lake to the dry ground. The fish; the mussels, snails, crawfish, and frogs. Adaptations of each to the various stages of transition. Consider the problems which relate to breathing, locomotion, food-getting, escape, defense, attack, concealment, etc.

2. In the dune areas: (*a*) The characteristics of plants that can gain a foothold on shifting sand. (*b*) The problem of moisture—how solved? (*c*) Effect of plant life on dune formation. (*d*) Conditions leading to discomfiture and the overthrow of dune plants. (*e*) The succession of plants on the dunes; characteristics of the latest plants. The birds and insects of the dunes and on the lakeshore. Food and nests. Care of young.

3. Dry clayey uplands: Adaptations of grass and other characteristic plants of dry grounds with the rushes and sedges of the marshes. Contrasted with the dune plants. The effect of stable conditions upon the form and growth of plants. Traces of animal life. Contrast with that found in the marshes in variety and richness.

4. Woodland areas: The adaptations of the smaller plants to the subdued light of the woods. The successions of plants from the open prairie to the

deep woods. Modifications noted in plants of the same kind. The adaptations of animal life: (a) birds, (b) insects. Contrasts with those found in other areas.

In general, note carefully the biological boundaries of each area—the frontiers of each. Also the efforts of various individuals to encroach upon adjacent areas. Look for signs of gain or loss to the individuals that attempt such invasions.

Associated with these studies will be the observation and consideration of devices for the distribution of seeds, for preparation for winter, migration, hibernation, etc.

II. *Observation of physical conditions.*—1. The sun: (a) By means of the skiameter in the school yard the slant and distribution of the sunshine will be directly measured. By comparing the area of the sun spot on the board with the area of the end of the box, the relation of the sunshine distribution in this latitude to that when the sun is vertical may be determined. (b) Determination of amount of sunshine each day. (c) Record of temperature of air and soil.

NOTE.—The skiameter is a wooden box three feet long and ten inches square, open at both ends, and hinged at one end to a board a foot wide. On one side a protractor is fastened, from the center of which hangs a plumb line. To find the slant and distribution of the noon sunshine, place the board to which the box is hinged in a horizontal position on a north and south line, with the free end of the box to the south. Incline the box so that the largest possible light area may be formed by the sunshine passing through the box. By means of the plumb line and the protractor read the slant. By means of a ruler measure the area of the sunshine area on the board, and keep a record of both. To get the same data at any other hour of the day, simply turn the bottom board so that the box may be pointed toward the sun.

2. Rainfall: (a) Observation of cloudiness and measurement of rainfall. (b) Determination of amount of water in given rainfall. (c) Graphic representation of monthly rainfall. This will be done by measuring the quantity of water that falls on a small area, say three inches square, and placing the same in glass jars. (d) Use and reading of barometer and other meteorological instruments.

3. Soils: Examinations of the physical properties of the soils of the different areas visited.

III. *Expression.*—Appropriate expression—painting, drawing, making, modeling, and writing—will accompany the study throughout. Each pupil will represent as graphically as possible the phenomena of the landscape as a moving picture. A series of paintings will represent the shading of summer into autumn, and of autumn into winter. Diagrams, models and charts, and written work will supplement these so that, as nearly as may be, the unity of the nature movement will be represented.

IV. Glass aquaria will be stocked in all the rooms with specimens of animal and plant life gathered on the field trips. These will furnish

materials for microscopic work. During the month the school will plant tulip, hyacinth, and other bulbs in the school ground in preparation for the flower and vegetable garden to be made in the spring.

V. *Practice teaching*.—When the students can show by a carefully prepared plan that they are ready to give a series of lessons under some one of the foregoing topics, arrangements will be made for such lessons to be given either in the model school or before members of the professional school. These plans must show grasp of subject-matter and power of adaptation to the needs and conditions of those for whom the work is prepared.

VI. *Pedagogical notes*.—The method in teaching the lessons outlined in nature study will involve the following points :

1. Gathering of data : This will be by direct observation.
2. When possible, that is, when quantities are considered, a careful *determination of proportions*; this will involve appropriate measurements and mathematical calculation.
3. The facts represented in the data *must be rendered objective* in some manner which will graphically and clearly represent the various relations observed. As, for example, the variation of sunshine distribution, of rainfall, etc., must be represented by actual areas, and amounts so measured and represented as to present the facts clearly to the senses
4. The facts derived from the data *must be reincarnated in a great nature-picture*; that is, for example, when (1) the rainfall on a small area of a few square inches has been observed; and (2) after its amount has been determined; and (3) after this has been actually measured out, so that the pupil can realize through the senses what it means; then (4) the great nature-picture must be developed by showing what this amount means for a given area, say the garden, a corn field, or the corn belt, wheat belt, etc. Unless the fourth point is reached, the work will lack that practical application which is the final stimulus for the study. It is through the development of the great nature-picture that man's relations will appear. The *great nature-picture* is thus the beginning of the pupil's observation, and is the end of all his investigation. All else are but intermediary processes.

FIELD WORK.

IRA B. MEYERS.

Plant life.—A general survey of any considerable area leads to the discovery that plants are not distributed indiscriminately, but that their occurrence is determined, to a greater or less degree, by the topographic features of the area—stream margins, swamps, prairie, bluffs, uplands—each feature having some distinguishing characteristic in the nature and grouping of its vegetative covering. These characteristic groups are frequently termed "plant societies," and are known as swamp societies, prairie societies, rock societies, etc., according to the nature of the topographic features.